

New Combustion CFD Algorithms Designed for Rapid GPU Computations, Phase I

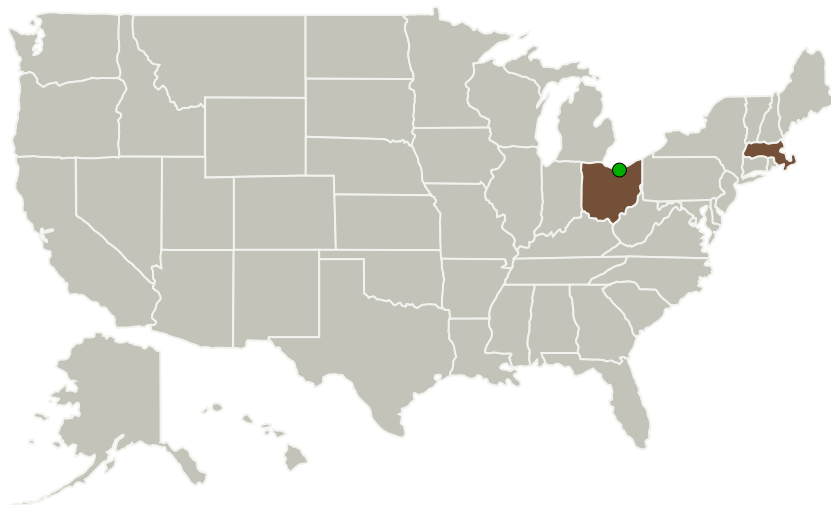
Completed Technology Project (2011 - 2011)



Project Introduction

We propose development of new algorithms specifically designed to exploit the highly parallel structure of graphics processing units (GPUs) for performing the following most expensive, but parallelizable computations in combustion CFD: (1) Chemical kinetics source term (including Jacobian matrix) evaluation; (2) Transport property evaluations; and (3) Matrix factorizations and inversions. The algorithms developed in this work will be implemented as software modules that can be easily interfaced with arbitrary CFD solvers for rapid computations using GPUs. A user guide will be delivered with directions for coupling the provided algorithms with users' CFD programs. Phase I work will demonstrate the computational acceleration achieved using the preliminary algorithms; and Phase II work will optimize the algorithms for improved performance and implement the algorithms as well-documented, distributable software modules as described above. This work will significantly increase the predictive capability of combustion CFD simulations by enabling efficient application of much larger chemistry models (which is essential, but currently prohibitively expensive) for accurately modeling the combustion of practical fuels.

Primary U.S. Work Locations and Key Partners



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Organizations Performing Work	Role	Type	Location
Aerodyne Research, Inc	Lead Organization	Industry	Billerica, Massachusetts
● Glenn Research Center(GRC)	Supporting Organization	NASA Center	Cleveland, Ohio

Primary U.S. Work Locations	
Massachusetts	Ohio

Project Transitions

February 2011: Project Start

September 2011: Closed out

Closeout Documentation:

- Final Summary Chart(<https://techport.nasa.gov/file/138352>)

Organizational Responsibility

Responsible Mission Directorate:

Space Technology Mission Directorate (STMD)

Lead Organization:

Aerodyne Research, Inc

Responsible Program:

Small Business Innovation Research/Small Business Tech Transfer

Project Management

Program Director:

Jason L Kessler

Program Manager:

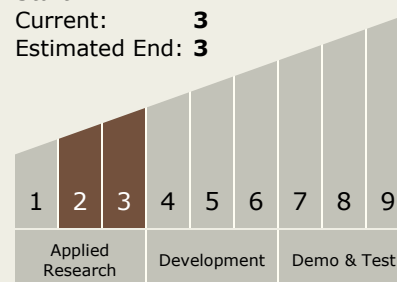
Carlos Torrez

Principal Investigator:

Oluwayemisi Oluwole

Technology Maturity (TRL)

Start: 2
Current: 3
Estimated End: 3



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Technology Areas

Primary:

- TX15 Flight Vehicle Systems
 - └ TX15.1 Aerosciences
 - └ TX15.1.7 Computational Fluid Dynamics (CFD) Technologies

Target Destinations

The Sun, Earth, The Moon, Mars, Others Inside the Solar System, Outside the Solar System